NOVEMBER 2022

Regional Planning Process Review – Non-Wires Update

ieso
Connecting Today. Powering Tomorrow.

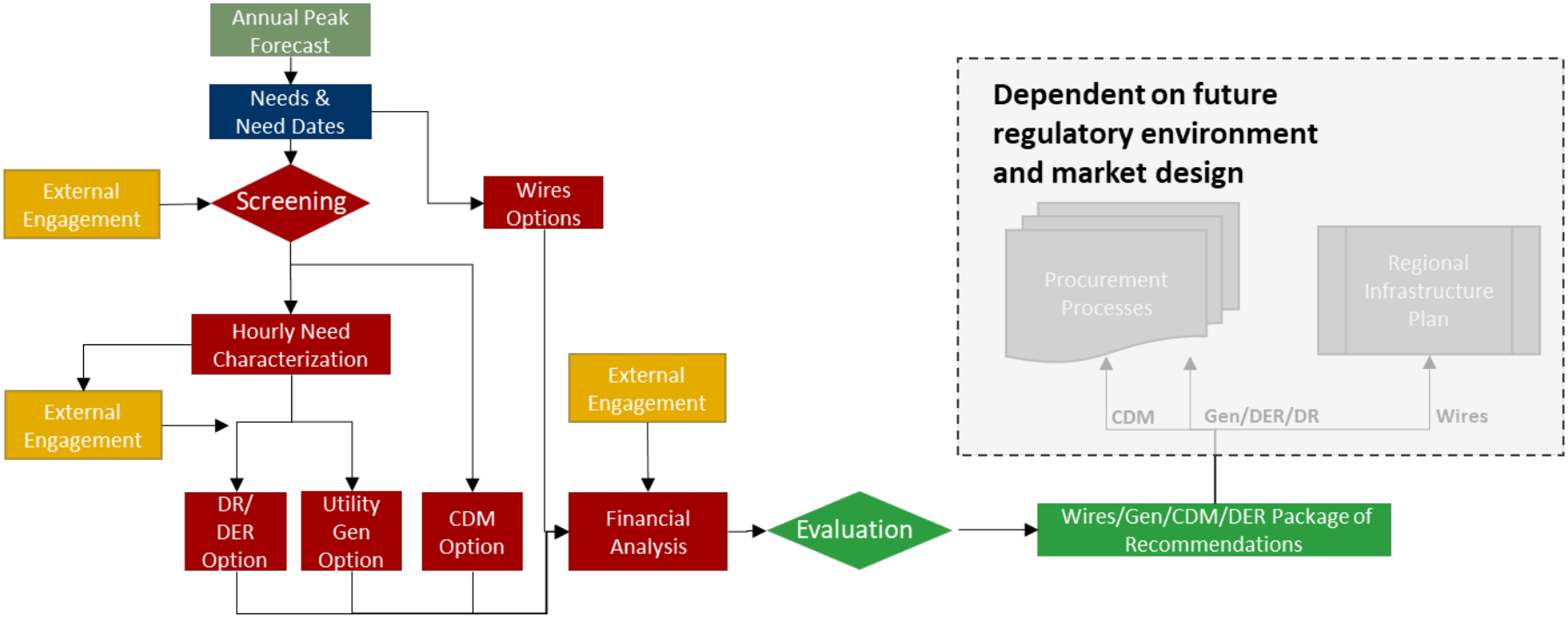
Background

- The IESO completed the Regional Planning Process Review in early 2021
- This initiative included identifying:
  - Key areas in the process for enhancement
  - Potential barriers to implementing NWAs in regional planning
  - A coordinated, cost-effective, long-term approach to replacing transmission assets at end-of-life
- The final report details various recommendations to improve the regional planning process
- The IESO and OEB collaborated to identify the organization responsible for the review and implementation, if appropriate, of each recommendation
- Implementation of process improvements for the consideration of non-wires alternatives ("NWAs") during IRRPs is IESO-led

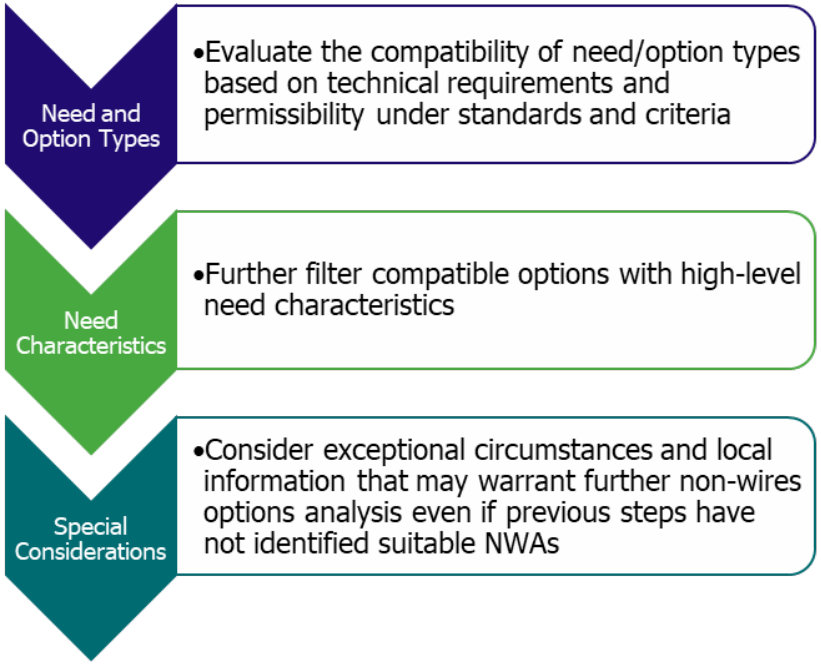
IRRP NWA Process Improvements To Date

- First cycle Integrated Regional Resource Plan ("IRRP") analyses were well suited for traditional wires and utility scale generation solutions
- In the past few years, the process and methodology for studying NWAs have incrementally evolved
- Most of the changes presented today are not "new" – they have now appeared in recent IRRPs such as Niagara or GTA West
- Improvements will continue to be iterated upon over upcoming IRRPs
- Summarizing and formalizing the incremental evolution is needed to:
  - Enhance transparency to stakeholders
  - Improve consistencies between regions
  - Leverage lessons learned in past regional plans and pilots
- The following slides will summarize the improvements made to date: process formalization, a new screening mechanism, needs characterization, and a more comprehensive options analysis methodology

IRRP NWA Process Diagram



Screening Mechanism



- A screening mechanism was introduced to occur early in the IRRP study, after local reliability needs are known but before options analysis
- It helps focus stakeholder discussions and direct time-intensive aspects of detailed NWA analysis towards the most promising opportunities
- Adding a screening mechanism also improves transparency in the IRRP's decision-making process

Hourly Needs Characterization (1)

- Studying peak demand hours is sufficient for sizing wires options because they are generally available in all hours once in service
- Evaluating the feasibility of NWAs, particularly energy-limited dispatchable options, requires needs to be quantified in greater granularity (duration, frequency, magnitude)
- The first step is to create hourly demand profiles to better understand reliability needs in all hours of the forecast year

- This activity has been introduced to the IRRP development, and includes two parts:

1. **Hourly forecasting** for areas or stations with needs based on historical load behaviour, weather, calendar variables, and other factors
2. **Needs characterization** to quantify the magnitude, frequency, and duration of overloads, and capture how they are dispersed over the days, months, and years in the forecast horizon

Hourly Needs Characterization (2)

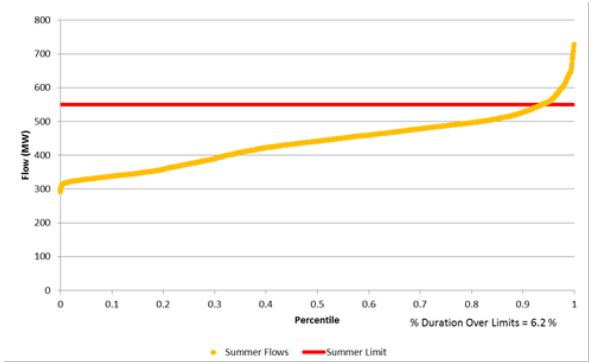
Step 1: Model Training

- Inputs: historical variables data and historical hourly demand
- Output: multiple linear regression model

Step 2: Model

- Inputs: static explanatory variables and dynamic weather variables
- Output: forecast hourly demand profiles

Sample Outputs



MW Range	1	2	3	4	5	6	7	8	9	10	11	12
500+	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
444	2%	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%	2%
389	4%	4%	2%	0%	0%	0%	0%	0%	0%	2%	2%	3%
333	4%	4%	3%	0%	0%	0%	0%	0%	0%	3%	3%	4%
278	6%	5%	4%	0%	0%	0%	0%	0%	0%	5%	5%	5%
222	7%	6%	6%	0%	0%	0%	0%	0%	1%	6%	6%	6%
167	7%	7%	7%	1%	1%	0%	0%	0%	3%	7%	7%	7%
111	8%	8%	8%	5%	5%	4%	5%	5%	6%	8%	8%	8%
56	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
0	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
Month												

Selecting Options in IRRPs

Demand Response Options

- Demand response (DR) potential has been difficult to quantify in the past
- Typically use past auction offer information to assess cost-effectiveness, but some issues arising from this approach include: offers made previously are based on the capacity product at the time, available supply of DR, and target capacity can change, etc.
- In 2021, the IESO commissioned Dunsky Energy and Power Advisory to develop a DER Achievable Potential Study that highlights the types and volumes of distributed energy resources likely to emerge in Ontario over a 10-year timeframe that is both achievable and economic
- This study, along with historic auction offer information and DR contribution to local adequacy, are now considered when assessing DR potential in IRRPs

Energy Efficiency Options – APS and Analysis

- In 2019, the IESO and the Ontario Energy Board completed the first integrated electricity and natural gas achievable potential study in Ontario (2019 APS)
- The APS identifies and quantifies potential energy savings, GHG emission reductions, and associated costs from demand side resources for 2019-2038
- The study shows potential for energy efficiency across all sectors and is used to inform future energy efficiency policy, plus program design and implementation
- The APS also supports assessments of Conservation and Demand Management (CDM) as non-wires options in regional planning
- Based on APS results, the maximum amount of system cost-effective demand reduction for each zone in ON can be calculated
- In IRRPs, analysis can then be done to estimate the incremental CDM that could be targeted in any given area

Energy Efficiency Potential – Implementation

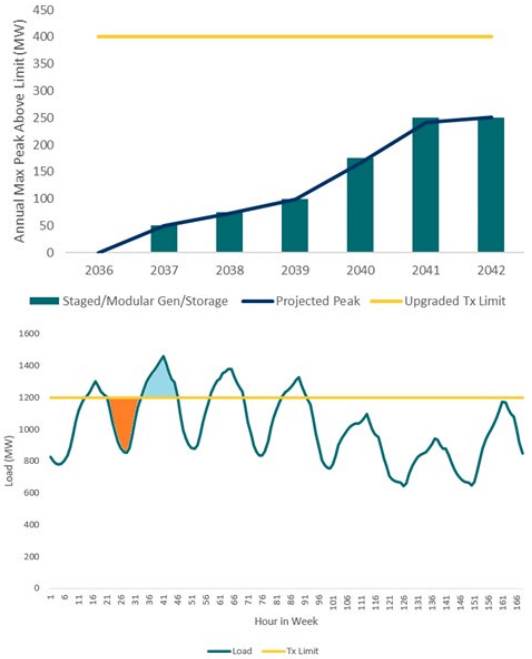
- Input from the IRRP Technical Working Group helps to refine assumptions in the analysis and explore options to target system cost-effective EE to the region
- The Local Initiative Program, under the 2021-2024 CDM Framework, is one tool available to target delivery of additional CDM savings to specific areas of the province with identified local needs
- A review of the opportunity for CDM to be targeted to address regional or local needs and available tools to do so under the current framework is underway as part of the 2021-2024 CDM Framework Mid-Term Review (to be delivered in Dec. 2022)
- The IESO is also working to refresh the APS modeling to incorporate updated demand and avoided cost assumptions; results are planned to be shared via a public webinar in late 2022

Generation & Storage Options

- The technology type and sizing of generation and storage options are determined by the need characteristics
- These characteristics are quantified by the energy-not-served (ENS) profile – the forecast hourly demand above the load meeting capability (amount of demand that can be served by existing infrastructure)
- The ENS profile is not static over the planning horizon; the capacity and energy requirements evolve as demand grows and influences the feasibility and economics of various generation and storage options
- Whereas wires and non-energy-limited solutions can be sized based on the capacity requirements alone, energy-limited resources must also consider the energy requirement and temporal patterns

Generation & Storage Options – Sizing

- Storage options need to be sized to "peak shave" the local load profile such that it never exceeds the transmission limit
- The analysis considers the energy that the storage could charge overnight, the amount (and shape) of energy that needs to be delivered, and the storage reservoir size requirements
- This approach can also be applied to storage paired with variable generation
- Both generation and storage options can be deployed in discrete blocks



Evaluating NWAs in IRRPs and Cost Comparisons

- NWAs should aim to cost-effectively meet the IRRP need on an equivalent reliability basis
- There are a few methods to assess cost-effectiveness, but ultimately we want an apples-to-apples comparison (i.e., compare the same dollars, to the same need (size and timing) and provide the same level of reliability/performance)
- Other qualitative attributes (i.e. fast ramp rates, flexibility in operation, dispatchable, etc.) should be considered as well
- The Levelized Unit Energy Cost (LUEC) is the average price an electricity generator/storage facility must receive for each unit of energy it generates over its lifetime to break even
- Model used to calculate LUEC of alternative generation/storage options considers factors such as overnight capital costs, fixed O&M costs, variable O&M costs, fuel management fees, etc.)
- NWAs are often compared in levelized energy costs or levelized capacity costs

Discounted Cash Flow Analysis

- The LUEC, in addition to a Discounted Cash Flow (DCF) analysis, provides a means of assessing alternative options for regional planning purposes
- The DCF model finds the net present value of expected future cash flows of the resource cost and system benefit by using a discount rate
  - Future cash flows are "discounted" at a rate that reflects the time-value of money and the inherent risk associated with future uncertainty
- A DCF model is made for each IRRP option, which at a minimum includes the following considerations:
  - Cost of the option (i.e. LUEC) amortized across its lifetime
  - Bulk system energy and capacity benefits (currently valued at an estimate of the cheapest cost of new capacity)
    - Note that the wires option also accounts for the cost of system resources delivered

Next Steps: Implementation Pathways

- The IESO will continue making improvements to the non-wires options development during IRRPs, as needed
- A guide to NWA assessments in IRRPs will be posted by early 2023
- Upcoming work (2023+) will focus on exploring the procurement mechanisms and potential implementation pathways for NWAs along with those already under evaluation for energy efficiency